

REMARKS

Claims 16, 20 and 60 are amended. Claims 19 and 61 are cancelled. New claims 65 and 66 are added. Claims 8-10, 14-16, 20-21, 47-52, 54-55, 57-60 and 63-66 are pending in the application.

Claims 8-10, 14-16, 19-21, 47-52, 54-55, 57-61 and 63-64 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over the combination of Ding, U.S. Patent No. 5,814,563; JP200-349071 ('071); Wolf "Silicon Processing for the VLSI Era" Vol. 2, pages 40 and 52-54 and Vol. 1, pages 55-57; or in the case of claims 47 and 50 the combination of Ding, '071 and Wolf in further view of Lucent Technologies. The Examiner is reminded by direction to MPEP § 2143 that a proper obviousness rejection has the following three requirements: 1) there must be some suggestion or motivation to modify or combine reference teachings; 2) there must be a reasonable expectation of success; and 3) the combined references must teach or suggest all of the claim limitations. Each of these three factors must be shown in order to establish a *prima facie* case of obviousness, the burden of which is upon the Office. Claims 8-10, 14-16, 20-21, 47-52, 54-55, 57-60 and 63-64 are allowable over Wolf, Ding, '071 and Lucent Technologies for at least the reason that the references, individually or as combined, fail to disclose or suggest each and every element in any of those claims, fail to provide motivation for the combination and fail to provide a basis for a reasonable expectation of success.

Referring initially to independent claim 16, as amended such recites etching silicon nitride through a mask opening using an etch chemistry having reactive components consisting of ammonia and at least one fluorocarbon selected from the group consisting of CF₄, C₄F₆, C₄F₈, C₂F₆, C₃F₈, C₅F₈, and chlorofluorocarbons. Claim 16 additionally recites

that the etching chemistry comprises a volumetric ratio of all fluorocarbon to ammonia of from 40:1 to 20:1 and provides increased selectivity to photoresist than would occur under conditions without any ammonia, the etching of the silicon nitride occurring substantially anisotropically. The amendment to claim 16 is supported by the specification at, for example, page 7, lines 3-11. As indicated at pages 2-3 of the present action, Wolf is relied upon as showing etching through a patterned mask which can comprise utilizing a dry etch of CF₄ gas. As acknowledged by the Examiner at page 2 of the present Action, Wolf does not disclose or suggest utilization of ammonia or the recited utilization of ammonia combined with fluorocarbons.

Ding discloses selective etching dielectric layers utilizing a process gas which includes fluorohydro-carbon gas, NH₃-generating gas, carbon-oxygen gas and optionally and inert gas (col. 5, ll. 45-57). Applicant notes that not one of the fluorocarbons recited in claim 16 qualifies as a fluorohydro-carbon as required by Ding, which specifically defines fluorohydro-carbon gas as a gas that includes carbon, fluorine and hydrogen (col. 6, ll. 4-7). Accordingly, Ding does not disclose or suggest the claim 16 recited at least one fluorocarbon selected from the recited group of fluorocarbons. As combined with Wolf, Ding does not contribute toward suggesting the claim 16 recited etch utilizing etch components consisting of ammonia and at least one fluorocarbon selected from the recited group.

Applicant further notes that claim 16 specifically recites that the etching chemistry reactive components consist of ammonia and the at least one fluorocarbon from the recited group. Ding does not disclose or suggest the recited etching chemistry, the reactive components of which consist of ammonia and at least one fluorocarbon. The Examiner

indicates at page 9 of the present Action that Ding merely suggests addition of carbon-oxygen gas to enhance etching process and does not teach that the gas is a mandatory addition, relying on the Ding disclosure at column 2, lines 57-59 and column 12, lines 40-50 and 62-66. However, the Examiner's consideration of isolated portions of the Ding disclosure at the indicated sites ignores the requirement that the reference must be considered as a whole (MPEP § 2141.02). Ding very clearly indicates at column 5, lines 45-57 that the etching process of the invention utilizes a process gas which includes fluorohydro-carbon, NH_3 -generating gas, a carbon-oxygen gas and optionally an inert gas (the carbon-oxygen gas is not indicated as being optional). The Examiner further indicates at that Ding does not use the additional carbon-oxygen gas within the 2.5:1 to 7:1 range (referring to the fluorocarbon to ammonia ratio). Even if the Examiner's statements were true, Ding still does not suggest the recited fluorocarbon to ammonia ratio of from 40:1 to 20:1 in an etching chemistry having components consisting of ammonia and at least one fluorocarbon. Further, because Ding does not disclose or suggest any of the fluorocarbons recited in claim 16, Ding cannot contribute toward suggesting the recited fluorocarbon to ammonia ratio of 40:1 to 20:1 where the fluorocarbon is selected from the recited group.

The Examiner indicates at page 10 of the Action that because Ding teaches four fluorocarbons that are also disclosed in applicants specification, and because applicants specification does not indicate criticality of specific fluorocarbons, selection of fluorocarbons not within the Ding disclosure would be obvious because reciting the selected fluorocarbons would be "similar to reciting a list of decreasing quantitative ranges with no criticality taught", (relying on case law for criticality of ranges). Applicant first notes that nowhere does applicant's specification teach or suggest that all fluorocarbons

disclosed are equivalent, and such cannot be read into the claims or the specification. Second, the Examiner has not provided any basis for extending the “critical ranges” case law to include distinct compounds. The Examiner also indicates reliance upon *Sinclair & Carroll Inc v. Interchemical Corp.*, 325 U.S. 327, 65 USPQ 297, as supporting the present rejection because “[r]eading a list and selecting a known compound is no more ingenious than selecting the last piece to put in the last opening in a jig-saw puzzle” (quoting *Carroll*). However, in *Carroll* the Court upheld a finding of obviousness based upon applicants specific indication that the recited solvent was selected from a catalog based upon boiling point to meet a known requirement, the claim being otherwise anticipated by prior art. Here the only listing of the compounds recited in claim 16 is within applicant's specification. Additionally, claim 16 is not otherwise anticipated by any art reference. For these reason, and because the only suggestion for utilizing NH_3 in combination with the fluorocarbons as recited in claim 16 is within applicants specification, a finding that the combination is obvious would necessarily constitute improper hindsight reconstruction.

Referring to the '071 reference, such discloses specific utilization of C_5F_8 (octafluoro cyclopentene) to avoid utilizing agents such as CF_4 , C_2F_6 and C_3F_8 (translation at Table 1, paragraphs 5-6, 15, 19 and 22). Because '071 specifically teaches away from utilizing CF_4 , C_2F_6 and C_3F_8 , the reference is unavailable to rely upon as suggesting any of these three compounds. Additionally, '071 does not disclose or suggest any etch chemistry comprising NH_3 . The '071 disclosure specifically indicates that nitrogen, defined as N_2 , is included according to need (paragraph 6) and specifies throughout the disclosure the amount of N_2 utilized. The Examiner indicates at page 6 of the present Action that the '071 reference teaches a “nitrogen source (commonly ammonia)”. The Examiner is mistaken. The '071

reference teaches only N_2 and accordingly does not provide a basis for the Examiner's reliance as teaching ammonia.

As combined with Wolf and Ding, '071 does not contribute toward suggesting the claim 16 recited etching silicon nitride utilizing etching chemistry having reactive components consisting of ammonia and at least one fluorocarbon selected from the recited group, the etching chemistry having a volumetric ratio of fluorocarbon to ammonia of from 40:1 to 20:1. Further, the combination of Wolf, Ding and '071 fails to provide a basis for a reasonable expectation of achieving the claim 16 recited increased selectivity during substantial anisotropically etching a silicon nitride layer utilizing etch chemistry having reactive components consisting of ammonia and at least one fluorocarbon selected from the recited group. Accordingly, independent claim 16 is not rendered obvious by the cited combination of Ding, Wolf and '071 and is allowable over these references.

As indicated at page 7 of the present Action, Lucent Technologies is relied upon as showing a specific type of photoresist. However, as combined with Wolf, Ding and '071, Lucent Technologies fails to contribute to the claim 16 recited etch chemistry having reactive components consisting of ammonia and at least one fluorocarbon selected from the recited group or the recited fluorocarbon to ammonia ratio. Nor does Lucent Technologies contribute toward finding a basis for a reasonable expectation of achieving the substantially anisotropic etch of silicon nitride with increased selectivity to photoresist utilizing etching chemistry having reactive components consisting of ammonia and at least one fluorocarbon selected from the recited group. Accordingly, independent claim 16 is not rendered obvious by the cited combination of Wolf, Ding and '071 as further combined with Lucent Technologies and is allowable over these references.

Claim 19 is cancelled. Dependent claims 8-10, 14-15, 21 and 47-50 are allowable over the cited combinations of Ding, Wolf, '071 and Lucent Technologies for at least the reason that they depend from allowable base claim 16.

As amended, independent claim 20 recites etching silicon nitride through a mask opening using etch chemistry having reactive components consisting of ammonia and at least one of C_4F_6 and C_5F_8 , the etching chemistry comprising a volumetric ratio of fluorocarbon to ammonia of from 40:1 to 20:1. Claim 20 is allowable over the cited combinations of Ding, Wolf, '071 and Lucent Technologies for at least reasons similar to those discussed above with respect to independent claim 16.

Claim 60 is amended to properly depend from independent claim 20. Claim 61 is cancelled. Dependent claims 51-52, 54-55, 57-60 and 63-64 are allowable over Ding, Wolf, '071 and Lucent Technologies for at least the reason that they depend from allowable base claim 20.

Claims 65-66 do not add "new matter" to the application since each is fully supported by the specification as originally filed. Claims 65-66 are supported at, for example, page 7, lines 3-11 and page 8, lines 5-14. Claims 65-66 are allowable over the art of record for at least reasons similar to those discussed above with respect to claim 16.

For the reasons discussed above, pending claims 8-10, 14-16, 20-21, 47-52, 54-55, 57-60 and 63-66 are allowable. Accordingly, applicant respectfully requests formal allowance of such pending claims in the Examiner's next action.

Respectfully submitted,

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